Are PDFs a thing of the past?

How do users navigate through technical content in order to locate and process information? A study conducted by the University of Leuven in Antwerp sheds light on navigation behavior, user interests and motivation.

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By Birgitta Meex and Geert Brône

Digitalization and connectivity affect all aspects of our lives and all industries. The digital revolution also impacts technical communication in that it establishes a new kind of interaction between users and a product. User expectations are changing accordingly. Surveys and recent studies reveal a trend towards dynamic content delivery systems. Customers not only ask for better search capability, possibly using faceted search, they also request content on mobile devices as well as videos, audio, and animations. For example, the recent eDoc project on the (electronic) delivery of user information, carried out by tekom, revealed the users' demand for "just-in-time", context-sensitive, and individualized information. Information should be designed in a responsive manner to provide an optimal viewing and interaction experience across multiple media that mutually complement each other (Fritz & Klumpp 2015). The eDoc guideline foresees that user information will be delivered increasingly electronically across different output media, to the extent that electronic delivery will become the standard. In line with this finding, the DCL and CIDM 2015 Trends Survey observes a move from PDF to HTML publishing.

Pros and cons of PDFs

Some of the often-heard shortcomings of PDF (and paper) in comparison to online documentation are its limited navigation options and multimedia support as well as its low degree of responsiveness. Once designed as a world standard for long-term archiving, PDF is now more and more seen as an outdated format, mostly due to the availability of an immense variety of ways to deliver user information electronically that meets the users' altered needs. However, despite the excellent availability of relevant technologies and the fact that people have been predicting its demise for a long time, PDF is still the most popular format used on the Web today. According to the tekom Spring Survey (Straub 2015) and the DCL and CIDM 2013, 2014 and 2015 Trends Surveys respectively, most content is still published in printed form or as PDFs delivered through the corporate website. Of course, every delivery format brings its own pros and cons. It is assumed that from a user's perspective, reading PDFs is similar to reading a paper copy. Usability arguments in favor of PDFs are the search options, the possibility of printing on paper, the offline functionality and the large selection of PDF readers available. Cons are the dependency on the availability of a device, the risk of incorrect selection when downloading lists, and the poor responsiveness (Fritz & Klumpp 2015).

A tracking study

In order to gain more insight into the pros and cons of delivery formats in general and PDFs in particular, as well as into how information is gathered in a user manual, it is helpful to empirically test how users handle documentation. So far, little research has been done to investigate this. To fill this research gap, we conducted an experimental study using screen tracking software to track the dynamics of users' navigation paths through a PDF document. The objective of this pilot study was to assess participants' viewing, scrolling, clicking and tapping behavior, their choices and lingering time and relate the information obtained to subsequent task performance (viz. an information search task) at a later stage. Furthermore, we can learn from the navigation behavior whether participants prefer modern video formats over the more traditional PDFs to acquaint themselves with (new) technical content. Moreover, screen (inter)actions were captured to measure content usage and (re)viewing times.

The navigation metaphor

For our pilot study, we took the navigation metaphor as our point of departure. Following Guiard & Chapuis (2007), we assumed that users navigate over a path when they move through the 2D content space of an electronic document covered with technical information to be discovered:

> "Traveling one's virtual camera in Euclidian 3D space, hovering over the flat landscape of a document, in such a way as to shift spatially and rescale one's view of the document"
>
> (Guiard, Du & Chapuis 2007: 2).

The path is understood to be summative, i.e. the information is cumulated in time during the navigation process.

Research questions

We addressed the following questions that emerged from the navigation metaphor:

- How do users navigate through web-based technical content space while performing a typical exploration task?
- Which particular contents do they look at in which order and how much time do they spend lingering on those contents?
- Do participants prefer PDFs or videos to gather (new) technical information?
- Can the preliminary findings of this small-scale study confirm the latest industry trends?
- What can content designers learn from users' navigation behavior to create user-friendly technical content and to guide the development of future formats?

Method

We set up a controlled experiment in a typical task-oriented setting of users navigating in a Web environment. The task was designed to reflect a semi-real usage scenario in line with HCI (human-computer-interaction) reality. As a test case, we took two Dutch online PDF manuals of "TV Vlaanderen", a digital satellite television service provider for the Flanders region in Belgium. Participants could access both manuals (one for the satellite and one for the recorder) and their corresponding videos from one and the same page to assure equal visibility. Moreover, the order of the presentation of the delivery formats was randomized. The PDFs contained embedded illustrations and links to websites.

We selected twelve participants, all students at the University of Leuven in Antwerp without


TV VLAANDEREN DIGITAAL

INSTALLATIEHANDLEIDING
VOOR DIGITALE TELEVISIE VIA SATELLIET

1. Cover page of the manual

1. De inhoud van uw schotelset

Digitale ontvanger (type varieert per gekozen set)
Schotelantenne (64 cm)
Duo LNB (ontvangstkop)
Startpakket (incl. smartcard, de smartcard bevindt zich in de dubbele bodem van de doos van de set)
Muurbeugel
20m kabel (2x20m bij complete set voor hdtv met recorder)
Installatiekit

2. Contents

2. Plaats van de schotel bepalen

Om het TV VLAANDEREN signaal te kunnen ontvangen, is het essentieel dat de schotel 'vrij zicht' op de ASTRA-satelliet heeft. Houd bij het zoeken naar een geschikte plaats voor de schotel rekening met obstakels zoals in de illustratie weergegeven.

Om de richting te bepalen raden we u aan gebruik te maken van het bijgeleverde kompas. Zie ook hoofdstuk 11 en 12 van deze handleiding voor meer informatie over het plaatsen en uitrichten van de schotel.

TIP U dient de schotel te richten naar de plaats waar de zon tussen 12u en 13u staat. Op die manier bent u zeker van vrij zicht op de ASTRA satelliet. Kijk op www.tv-vlaanderen.be/uitrichten voor meer info.

U kan de laatste pagina van deze handleiding gebruiken als handig hulpmiddel bij het bepalen van de plaats van uw schotel.

Tip 1: Directing the satellite receiver

9. De bekabeling trekken

Verbind de kabel(s) aan de DUO-LNB. Indien u een complete set voor hdtv met recorder kocht, dient u de twee meegeleverde kabels aan te sluiten. Het andere uiteinde van de kabel(s) sluit u aan op de ontvanger naast uw televisietoestel. Voor het aansluiten van de ontvanger dient de kabel van buiten naar binnen te worden getrokken. Hiervoor moet er meestal in de gevel geboord worden.

Wenst u dit echter niet te doen, dan kan een tussenstuk platte coaxkabel een oplossing bieden. Dit maakt het mogelijk de kabel tussen ramen en deurspleten naar binnen te brengen. Deze kabels zijn verkrijgbaar bij de betere TV VLAANDEREN verkooppunten en in de TV VLAANDEREN webshop.

In geval van boren:
Boor het gat in de muur van binnen naar buiten, in een scherpe hoek naar beneden. Hiermee voorkomt u dat er mogelijk vocht in uw huis binnendringt.

Tip 2: Drilling a hole for the cable

10. Het aansluiten van een HD-ontvanger en HD-recorder

A. Sluit de andere kant van de lange coaxkabel aan en schroef deze goed vast op de SAT IN-ingang aan de achterkant van uw ontvanger. Bij een hd-recorder schroeft u de twee kabels vast op de SAT1-ingang en de SAT2-ingang.

B. Sluit uw ontvanger aan op uw tv-toestel door middel van een HDMI-kabel.

LET OP Heeft u nog geen "platte" tv dan dient u een SCART-kabel te gebruiken. Deze zit niet bij in uw doos en dient u dus nog aan te schaffen.

Warning 1: Connecting the receiver

Eerste Installatie

Bij matig of onvoldoende signaal, dient u de schotel eerst nauwkeuriger te richten. Dit doet u door de schotel langzaam naar links en/of naar rechts te draaien. Wanneer u hiermee nog niet het gewenste resultaat heeft kunt u eens proberen de verticale stand van uw schotel aan te passen. U plaatst de U-beugel op 29° en u probeert nog eens door langzaam naar links en/of rechts te draaien. U kunt dit ook doen door de U-beugel op 31° te plaatsen.

LET OP Bij het uitrichten van de schotel is het verschil tussen slechte kwaliteit en optimale kwaliteit slechts enkele millimeters. Neem hiervoor dus rustig de tijd om een optimale uitrichting te bekomen.

Warning 2: Finding the best signal

Figure 1: Pages containing special points of interest

Average overall	Contents	TIP 1	TIP 2	Warning 1	Warning 2
27.28s	27.12s	48.56s	44.97s	34.49s	20.54s
	p = 0.97	p = 0.0376*	p = 0.0318*	p = 0.27	p = 0.16

Table 1: Dwelling time

a technical background, and equipped them with a laptop with a headset and audio & video tracking software. They were asked to perform an exploratory information search to acquaint themselves with the content of the documentation and the functionalities of the devices. Consequently, as we asked them to follow an information gathering approach, the viewing task was goal-oriented only to an extent. We set a time limit of 30 minutes. Once the participants had completed the task, we conducted a short post-test interview, asking questions about format preferences, technical self-confidence (Beier 2004), and user experience in order to learn about users' subjective experiences and "joy of use". Upon completion of the viewing task, the participants were also presented with two content questions to check whether they could memorize highlighted content such as additional didactic information or safety-related information.

Participants' screen (inter)actions were recorded, using the screen-capturing program Camtasia Studio. The recorded data were analyzed both manually and by using the multimedia annotation tool ELAN. It should be noted that the viewing time per page was measured as the time between two scroll movements across document pages. When participants scrolled within a single page, this was calculated as a single instance of page reading.

Results

The data we collected for the student participants provide a first insight into the typical content navigation behavior in relatively traditional PDF documents. What is apparent is that all participants adopted a linear reading mode, meaning that they tended to read the manual from beginning to the end, very little direct navigation to non-adjacent sections of the text or clicking to other available resources (through links in the document). However, we also came across many instances of reviewing certain pieces of content. After they had gone through the PDF, half of the participants navigated again from the end of the document to the beginning as if they were following a breadcrumb trail. A possible explanation for this behavior might be that users tend to keep an overview and look at the document in total. This may, however, be an effect of the task design, as the participants were asked to familiarize themselves with the products by perusing the documentation (i.e. "reading-to-learn" design). Starting from a specific task or problem might generate a different reading behavior, and this will be the subject of future studies. A second observation pertains to the interaction with the available content: the participants, in general, did not interact with the textual or graphical content provided in the document by hovering over or highlighting specific segments. Again, this might be due to the task design at hand, but it seems to be a more general feature of screen-based reading.

In addition to the general observations on navigation behavior, we measured the lingering time (or dwelling time) of the participants on the separate pages of the PDF manuals. We were particularly interested in whether the participants tended to spend more time reading special points of interest in the document, such as warning messages, safety-related information, tips & tricks, and an overview of the content. We singled out five pages in the document (which had 20 pages in total) that contained this type of information, and which were marked as such (see Figure 1 for the cover page of the manual and the five relevant pages). We then calculated the mean viewing time for each of these pages and compared them to the average length of viewing time per page for the entire document. This gave us an indication of the relative impact of such special points of interest. The findings for this first exploratory study, as presented in Table 1, reveal that only in some cases was there a significantly longer dwelling time on these marked pages, especially on the two pages referring to specific tips & tricks (p. 3 and p. 12).

Another striking (but not surprising) observation is that the second part of the second PDF the participants looked at was frequently skipped, indicating that motivation seems to decrease over time. Regarding the question if participants viewed the user information in an order that was different from the order in which the user information was (randomly) presented to them, our observations show that two-thirds of them made no alternative delivery format choices. Finally, the post-test interview revealed that

- three-quarters of the content questions were answered correctly,
- participants displayed a clear preference for PDFs instead of videos, and
- fifty percent of them did not think of themselves as being competent enough to get started installing and operating the devices due to a self-attributed lack of technical aptitude.

Implications and lessons learned

Notwithstanding the rather small sample of users participating in the study, the results of this pilot study stress the importance for the technical communicator of developing effective user information. The ARCS Model of Motivational Design (Keller 1983, 1987) distinguishes four aspects of effective user information (see also Loorbach, Karreman & Steehouder 2006):

- Attention
- Relevance
- Confidence
- Satisfaction

First, effective user information increases the dynamics of attention and interaction so as to avoid users abandoning and giving up on the task. Second, it demonstrates the relevance of reading the documentation in that it tries to convince users of the usefulness for their purposes and to ensure continuous engagement with the task. Third, effective user information appeals to the emotions (e.g. fear, frustration) of the user and inspires his/her confidence in the task. In this way, it supports participants in feeling confident to get started using the product. And finally, effective user information yields greater customer satisfaction.

As motivation was shown to decrease dramatically over time, the addition of motivational elements might be useful to keep the user's attention (Loorbach, Karreman & Steehouder 2006). Metadata such as breadcrumb trails, tags (e.g. a bookmark, a checklist) and overviews may be useful to help users find content and to make content more searchable, i.e. allow it to be found (again) by browsing or searching. Different user groups might be identified depending on the navigation patterns they follow. In this way, technical documentation may be personalized to adjust it to these different needs.

Conclusion

With this pilot study, we intended to provide insights into how users navigate through technical content space in order to search for and process information. We assumed that navigation behavior, keyboard and mouse usage, lingering time, viewing order, reviewing times, and the format choices made are good implicit indicators of user interest and motivation. Navigational behavior gave us information about satisfaction and engagement with the task. Viewing history and lingering time allowed for assessments of attention and relevance. The post-test interview provided us with information regarding confidence into one's own technical competencies as well as relevance of the information.

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